

# Motivating Science Undergraduates: Ideas and Interventions

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## Abstract

This paper overviews three important motivational theories (the theory of self-efficacy, achievement goal theory, and the self-determination theory of intrinsic and extrinsic motivation) and explains their relevance for motivating tertiary students. The paper then briefly describes a project in which tertiary educators in science and other faculties have attempted to make their units of study more motivating and interesting for students. The paper concludes by outlining some aspects of the emerging sociocultural approach to motivation and the relevance of this approach for motivating students in educational contexts.

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## Introduction

In this article I overview three important motivational theories and briefly explain how they are relevant for motivating tertiary students. The motivational concepts discussed are, however, relevant for all contexts of life-education, work and the home. The article is limited to a general presentation of motivational theory and research in the absence of a body of motivational research in the domain of science, although the current special issue goes some way to addressing this deficiency. A recent chapter by Turner and Meyer (2009) has reviewed motivational research in mathematics, a disciplinary trend that is likely to gain momentum in the next decade in that same way that analyses of learning in diverse domains have proliferated since the early 1990's. The second edition of the *Handbook of Educational Psychology*, edited by Alexander and Winne (2006), for instance, has chapters on the learning of reading, writing, mathematics, science, social studies and second language learning. While there are a number of chapters on motivation in Alexander and Winne (2006) none of them focus on motivation in a particular knowledge domain.

In the first section of the article I discuss person-in-context approaches to motivation (Nolen & Ward, 2008); these theories see motivation as fundamentally individual in nature. In the second section, I write about the emerging sociocultural approach to motivation (Nolen & Ward, 2008) which sees motivation as fundamentally social in nature. My own recent work, and that of my research students, has been concerned with the development of this latter approach.

By way of introduction, before I turn to an examination of specific theories, I define motivation and then identify the main assumptions and emphases in person-in-context motivational theories. Motivation (Brophy, 2004; Pintrich & Schunk, 2002) is what energises people; it is what causes

people to engage in some activities and not others. It is what causes people to expend effort in the activities they engage in and what causes them to persist with activities, often in the face of considerable difficulty. Lack of motivation leads people to put minimal effort into their activities and not to persist with them. Furthermore, some types of motivation (Brophy, 2004; Pintrich & Schunk, 2002) cause people to avoid engagement in activities or to reduce their expectations of success.

Five main assumptions or emphases can be identified in person-in-context theories. Firstly, they are cognitive theories and are often described as ‘cognitive-motivational’ theories. That is, they assume that thoughts and other cognitive processes instigate motivations and emotions which in turn instigate engagement in activities, or lack of engagement, or even avoidance of particular activities. Thoughts are considered to instigate the processes which culminate in behaviour.

Secondly, they are often described as ‘social-cognitive’ theories because they recognise the role of the social and physical context on motivational processes. In my writing with colleagues and students (Walker, 2010; Walker, Pressick-Kilborn, Sainsbury & MacCallum, 2010; Walker, Pressick-Kilborn, Arnold & Sainsbury, 2004) I’ve referred to them as *social influence* theories because, compared to sociocultural theories of motivation, they give only a limited recognition to the role of the social world in motivating people.

Thirdly, these theories (Pintrich, 2002; Pintrich & Schunk, 2002) emphasise the way that the social and physical environment, the educational context, influences motivation. While it is recognised that people bring motivational orientations to academic situations, these theories emphasise the dynamic nature of motivation rather than the dispositional nature of motivation; motivation is mostly seen as a transaction between the person and the environment. In educational contexts, this emphasis, of course, places an important onus on the educator to create learning environments that motivate learners. While the word ‘disposition’ is used in the motivational literature the word ‘trait’ tends only to be used in the literature concerned with anxiety (Zeidner & Mathews, 2005) and its impact on achievement; the topic of anxiety is however, a component of the motivational literature.

Fourthly, these theories emphasise the importance of perceptions for motivational outcomes. The motivational literature shows clearly that two people may have similar knowledge, skills and abilities, objectively speaking, but that how they perceive their own skills and abilities is critical for their motivation. While two students may have objectively similar capabilities, their perception of their capabilities (Bandura, 1997) will influence their reactions to failure, for instance, with the consequence that a student lacking confidence in his or her capabilities will be deterred by failure while another, more confident, student will not be affected by failure outcomes.

Fifthly, these theories tend to emphasise either perceived competence or value beliefs. Theories which emphasise perceived competence, such as Bandura’s (1997) theory of self-efficacy, discussed below, also emphasise the expectancy beliefs which accompany those perceptions. In these theories, perceived competence and expectations of success and failure play a central role in motivational processes. Other theories emphasise value beliefs (Brophy, 1999, 2008). What is valued or important is considered from this perspective to play an important role in the motivational process. An emphasis on the value aspects of motivation is evident in the self-

determination theory (Ryan & Deci, 2000) account of the internalisation of extrinsic motivation, also discussed below.

Finally, while there is some disagreement on this issue, most motivational theorists (Brophy, 2004) agree that competition has negative effects on motivation and ultimately on learning and academic achievement. This is because there can only be one, or a limited number, of winners in a competition, and those who are not winners are likely to perceive themselves as failures. Approaching academic activities with a sense of confidence and a success orientation (Bandura, 1997; Martin & Marsh, 2003) is an important element in effective motivation and learning, while approaching academic activities with a lack of confidence and a desire to avoid failure, as will be seen below, has a detrimental effect on motivation, learning and academic achievement. Even worse is the situation where a lack of confidence is associated with an acceptance of failure (Martin & Marsh, 2003). Making one's own understanding and improvement the focus of learning is much more likely to lead to a sense of confidence and an expectation of success than competition with others, and an emphasis on social comparison. This perspective is largely borne out in the following overview of motivational theories, but is most evident in the examination of the achievement goal approach to motivation.

## **Overview of important motivational theories**

In this section I overview three important person-in-context motivational theories: the theory of self-efficacy, achievement goal theory, and the self-determination theory of intrinsic and extrinsic motivation.

### ***Self-efficacy theory***

This theory, developed by Albert Bandura in the late 1970's, is arguably the foremost motivational theory, and has led to a great body of research over the last thirty years (Bandura, 1997) in a wide range of domains, including health, education, sport and business. Self-efficacy theory, and its related research, supports a critical role for self-efficacy beliefs in academic learning, motivation and achievement (Zimmerman, 2000). In fact, this research (Bandura, 1997; Multon, Brown & Lent, 1991) has shown that self-efficacy beliefs or expectations are better predictors of achievement outcomes than prior knowledge, a highly important finding for educators concerned with motivation and achievement.

Self-efficacy (Bandura, 1997) refers to a person's belief or expectation that the person has the skill or ability to perform some task or activity. Self-efficacy beliefs impact on a person's cognitive and motivational processes and influence the activities people choose to become involved in. Experimental studies (Pajares, 1996) have demonstrated causal relationships between self-efficacy beliefs and achievement outcomes while correlational studies (Pajares, 1996), involving such statistical techniques as regression analysis, path analysis and structural equation modelling, have shown that self-efficacy expectations have direct effects on achievement outcomes and indirect effects on achievement through cognitive and motivational processes. Meta-analytic studies (Multon, Brown & Lent, 1991) of the relationship of self-efficacy beliefs and achievement outcomes have also shown that, depending upon a range of factors such as the educational level of the student and the subject domain, effect sizes are positive and moderate to large, thus reinforcing the important role efficacy beliefs play in achievement outcomes.

Efficacy expectations are generally assessed (Bandura, 1997) at the level of a specific task or problem, although they have been assessed at the levels of the subject or knowledge domain (Bong, 1997). In assessing efficacy beliefs, the researcher requires student self-report judgements that they have the skill or ability to perform a task or activity; this involves the student in making a judgement concerning the nature of the task and the skills it involves, but without the opportunity of actually completing the task. Time limits on exposure to the task are therefore needed in the assessment process. The most precise assessment (Bandura, 1997; Pajares, 1996) of efficacy beliefs has involved showing students specific tasks or problems for a limited period of time, on a powerpoint slide for instance, and then asking the student to rate their expectation on a ten point scale, ranging from ten to one hundred. The scores on each item are then aggregated to arrive at an efficacy score for the tasks under assessment. It has also become common, though not as theoretically or methodologically sound, to assess self-efficacy through the use of survey style instruments in which students are asked to rate their confidence that they can do something or other. These survey instruments generally have four or five response options, indicating low or high levels of efficacy.

Self-efficacy beliefs derive from four main sources (Bandura, 1997): actual experiences of success and failure, vicarious experiences involving the observation of others, verbal persuasion, and physiological cues which indicate anxiety. The most important source of efficacy beliefs are actual experiences of success and failure. Experiences of success will lead to increases in efficacy expectations while experiences of failure are likely to reduce efficacy expectations, although occasional experiences of failure are not likely to greatly diminish the expectations of efficacious people. Students who attribute their successes to their own capabilities and efforts will have higher levels of efficacy than those who attribute success to factors unrelated to their own capabilities and efforts. Similarly, students who attribute their success to their ability will have higher levels of efficacy than students who attribute their success to their efforts, as the expectation of future success will be greater when success is attributed to a stable factor like ability rather than to a variable or unstable factor like effort (Graham, 1991). On the other hand, efficacy beliefs will be most diminished when a student attributes failure to their own ability and effort, but will be diminished to a lesser extent when failure is attributed to factors considered to be unrelated to the student.

Efficacy beliefs are also influenced by vicarious experiences (Bandura, 1997) associated with observing the successes and failures of others. When students observe others succeeding their efficacy is raised and when they observe others failing their efficacy is diminished. The impact of observing others is greatest when the person observed is very similar to the observer, or when many different people are either successful or unsuccessful. While observation of others can be a powerful source of efficacy beliefs, it is not as significant (Bandura, 1997) as actual experiences of success and failure.

Efficacy beliefs can also be influenced by verbal persuasion (Bandura, 1997), that is, by telling people that they can or cannot succeed, but this is a less influential source than either actual or vicarious experiences of success or failure. Verbal persuasion may have its greatest impact when students are encouraged to expend greater amounts of effort; this effort may in turn lead to successful achievement outcomes.

Finally, physiological reactions (Bandura, 1997) such as those associated with anxiety are sources of efficacy, though to a lesser extent than the first three sources. These physiological

reactions serve as cues to the student concerning their capabilities. The experience of anxiety is a cue to the student that he or she has doubts about academic competence while the absence of anxiety may be a cue to the student that he or she is academically capable.

It needs to be noted, however, as indicated in the introduction, that efficacy beliefs, like other motivational constructs, involve perceptions. The sources of efficacy are influenced by the student's perception of his or her capabilities, so that some sources may be minimised or discounted in the light of the person's motivational disposition and self-perceptions. The sources of efficacy are also considered to go through a weighting processes (Bandura, 1989) before a final efficacy belief or judgement is arrived at. The consequences of these dispositional and self-perception processes are that two students with what an observer might consider 'objectively similar skills and abilities' may have very different levels of self-efficacy expectations (Bandura, 1997).

The significance of self-efficacy theory for motivating science undergraduates thus lies mostly in the sources of efficacy beliefs (Bandura, 1997; Schunk & Pajares, 2004). In short, the theory indicates that tertiary science educators need to create learning environments in which the experience of success is maximised and the experience of failure is minimised, and in which students are able to observe other students experiencing success. Encouraging students in their efforts and reducing anxiety will also help students to feel more efficacious. While greater discussion of ways in which the sources of efficacy beliefs may be tapped in educational contexts is beyond the scope of this article, there are several internet sites which provide suggestions for enhancing academic self-efficacy beliefs.

### ***Achievement goal theory***

Achievement goal theory had its origins in the early 1990's (Ames, 1992) and since that time has achieved prominence as a motivational theory with considerable relevance for tertiary and high school contexts. In addition to investigating achievement-related goals, achievement goal theorists (Urduan & Schoenfelder, 2006) have researched social goals, such as social responsibility goals, and academic work avoidance goals, which have positive and negative influences respectively on achievement.

Two main types of achievement goal have been identified (Urduan & Schoenfelder, 2006) in this literature. Mastery goals are concerned with increasing one's understanding and competence while performance goals are concerned with outperforming others, avoiding the perception of a lack of competence, and of demonstrating competence and ability with little effort. Mastery goals have been shown (Ames, 1992; Urduan & Schoenfelder, 2006) to be associated with deep approaches to learning, deeper cognitive processing of knowledge, and more effective learning strategies and metacognitive skills. Students with mastery goals prefer challenging tasks, have high levels of interest in what they are learning, and have positive attitudes towards education. With performance goals (Ames, 1992; Elliot & Moller, 2003) the student's attention is focussed on the self and on the impression that is made on others. In more recent years, performance goals have been differentiated (Elliot & Moller, 2003) into performance approach goals and performance avoidance goals. Performance approach goals are concerned with the demonstration of competence and have been associated with both adaptive and maladaptive (Elliot & Moller, 2003) patterns of learning. Performance avoidance goals are concerned with avoiding the demonstration of incompetence.

Studies have shown that students who adopt performance approach goals (Harackiewicz, Barron, Pintrich, Elliott & Thrash, 2002) have higher levels of achievement as demonstrated in mathematics problem solving, short answer exams, essay exams and grades. These students value their academic learning activities, have high levels of effort expenditure, and have positive self-concepts. They also demonstrate some maladaptive learning patterns: they tend to use surface or superficial approaches to learning, prefer to work alone, and are resistant to cooperative learning environments.

Performance avoidance goals have been shown to be associated exclusively with maladaptive learning patterns. Students who adopt these goals have lower levels of achievement, expend less effort on academic work, and are more likely to cheat. They have low levels of self-esteem, perceive their ability to be low, avoid challenging and novel tasks, and are less likely to ask for help (Karabenick, 2004) when they confront academic difficulties. These students are also more likely to engage in self-handicapping behaviour (Urduan & Midgley, 2001) in order to give themselves excuses for poor academic achievement.

Although there is as yet no direct evidence to support this view, achievement goal theorists (Ames, 1992; Urduan & Schoenfelder, 2006) and others (Martin & Marsh, 2003) consider that students who adopt performance goals, whether approach or avoidance, are more likely to be affected by failure experiences. It is suggested that experiences of failure may lead performance approach students to change from a success orientation to a failure avoidance orientation which may be associated with lower expectations of success, as well as self-handicapping behaviour (Urduan & Midgley, 2001). It is thought that the experience of failure may lead performance avoidance students to a failure acceptance orientation, and ultimately to the adoption of the learned helplessness attributional pattern (Graham, 1991) where success is attributed to factors outside of the individual while failure is attributed to a lack of ability.

For these and other reasons, most achievement goal theorists (Ames, 1992; Urduan & Midgley, 2001) argue that learning environments should focus on encouraging mastery goal orientations, although some have suggested that mastery goals in combination with performance approach goals (Harackiewicz & Linnenbrink, 2005) may provide the most appropriate learning environment for students. The adoption of mastery or performance goals (Ames, 1992; Urduan & Midgley, 2001; Urduan & Schoenfelder, 2006) by students depends upon the nature of the learning environment and what is emphasised in it. Mastery goals are encouraged when the emphasis is on understanding for its own sake, where errors are seen as providing feedback and are an integral part of learning, and where there is an emphasis on understanding the interrelationships amongst knowledge. Mastery goals are also enhanced by an emphasis on formative assessment or standards-based assessment, and by a friendly, democratic learning environment (Ames, 1992). Performance goals are enhanced (Ames, 1992; Urduan & Midgley, 2001; Urduan & Schoenfelder, 2006) by an emphasis on competition and social comparison, and in learning contexts where relative ability is emphasised and errors are seen as reflective of ability. They are also enhanced by an emphasis on summative and normative assessment and by an authoritarian learning environment.

### ***The self-determination theory of intrinsic and extrinsic motivation***

While a number of theories of intrinsic motivation have been developed since the 1950's, with a high degree of overlap amongst them, the self-determination theory developed by Ryan and Deci (2000) is the most recent and influential of these theories. As with the earlier theories of intrinsic

motivation, motivation is differentiated into two main types in self-determination theory. Intrinsic motivation is considered to be the motivation to do something for its own sake, for the intrinsic pleasure of engaging in the activity, while extrinsic motivation is the motivation to do something as a means to an end, for some utilitarian reason or for some incentive. Unlike earlier theories of intrinsic motivation, this theory also explains how extrinsic motivation can be internalised by students to become an important source of motivation.

Self-determination theory, along with other intrinsic motivation theories, argues that intrinsic motivation has its origins in innate needs for competence or mastery, autonomy, and relatedness or belongingness. Self-determination theory and research (Ryan & Deci, 2000) demonstrates that intrinsic motivation will be enhanced by learning environments which give students the sense that they are competent and have mastery over the academic activities they engage in. Intrinsic motivation is also enhanced when students have a sense of autonomy (Katz & Assor, 2007; Ryan & Deci, 2000) in their learning activities, that is when they are given choice in their learning, when their personal goals and interests are taken into account in the learning context, and when they are listened to by their teachers and receive feedback concerning their learning activities. Recent self-determination research from the perspective of the need for autonomy has demonstrated as well that the way a task is framed (Vansteenkiste, Lens & Deci, 2006) when presented to students can have a significant impact on their motivation. When students are told that they ‘might’ do such and such a thing, intrinsic motivation is more likely to result than when students are told that they ‘should’ or ‘must’ do such and such a thing. Intrinsic motivation is also more likely to result from learning environments where students perceive themselves as ‘belonging’ and where they experience a sense of relationship with others (Ryan & Deci, 2000), as opposed to alienating and unfriendly learning environments.

It is important to encourage intrinsic motivation (Ryan & Deci, 2000) because intrinsically motivated students learn better and learn more, have better organised knowledge, and have positive attitudes to the educational institutions in which they learn. Intrinsic motivation and learning have a reciprocal relationship, such that while intrinsic motivation promotes learning, so learning promotes skill development and a sense of competence, that is, intrinsic motivation. Extrinsic motivation, on the other hand, is more likely to lead to superficial and short-term learning (Deci, Koestner & Ryan, 2001). Intrinsic and extrinsic motivation should be considered to be two different forms of motivation, with each form of motivation on its own continuum from low to high. It is therefore conceptually possible to be high on both intrinsic and extrinsic motivation, or to be low on both, or to be high on one form of motivation and low on the other, though in different knowledge domains (Ryan & Deci, 2000).

A body of research conducted over a thirty-year period has demonstrated (Deci, Koestner & Ryan, 2001) that when students are intrinsically motivated giving them rewards undermines their motivation and reduces the quality of their academic work. These findings have been replicated with students ranging in grade from early primary to tertiary levels, and with many types of reward; these have included tangible rewards such as awards, as well as intangible rewards such as verbal praise. Similar findings have been found for deadlines, imposed goals, and situations involving student surveillance. Extensive research has provided support for two main theoretical explanations of the effects of rewards on intrinsic motivation. Firstly, there is support for the view that rewards cause learners to re-assess their reasons for engaging in academic activities, more specifically they encourage the learner to consider that he or she is motivated by the reward rather than the intrinsic pleasure of the activity. The second explanation focuses on the dual

functions of rewards, that of controlling behaviour on the one hand, and of providing informational feedback on behaviour on the other hand. Research into this issue (Lepper, Corpus & Iyengar, 2005; Ryan & Deci, 2000) has demonstrated that when rewards are perceived by students to have a controlling function, intrinsic motivation will be diminished. However, when rewards are perceived by the student to have an informational function they do not have a negative impact on intrinsic motivation. Consequently, educators need to be aware of the way their rewards, including verbal praise, are perceived by students. Before leaving this point, it should be noted that this research has been the subject of contested meta-analyses (Cameron, 2001; Deci, Koestner & Ryan, 2001) with the contestation arising from what might be called paradigmatic differences amongst researchers.

Whereas most theories of intrinsic motivation have taken a rather simplistic view of extrinsic motivation, the self-determination theory (Ryan & Deci, 2000) explains how extrinsic motivation may be internalised so that eventually it may become something like intrinsic motivation. This theoretical process of internalisation involves the concept of introjection, a Freudian concept, which makes the internalisation process very different from that of sociocultural theory, described below. The self-determination theory of the internalisation of extrinsic motivation (Ryan & Deci, 2000; Ryan & Deci, 2003) suggests that initially students are motivated by the desire for rewards or to avoid punishment. Later, they are motivated to engage in academic activities out of a sense of guilt, the sense that they 'should' engage in these activities because significant people in their lives, parents and teachers, consider that they should. At this stage in the internalisation process students are essentially controlled by their guilt-related emotions. At a later stage, students come to see the value of extrinsically motivated tasks, activities or knowledge domains. These domains or activities become personally important to the student and the student begins to set their own personal goals in relation to the knowledge domains or activities. From this point on, extrinsic motivation starts to become more like intrinsic motivation and starts to have learning outcomes not unlike the outcomes of intrinsic motivation. The self-determination theory of the internalisation of extrinsic motivation suggests that the internalisation of extrinsic motivation is enhanced by learning environments which meet student needs for competence, autonomy and relatedness. It is important then, that science educators create learning environments which address these student needs.

***Developing interventions on the basis of person-in-context motivational theories: Making university units of study motivating for students.***

The previous section of this paper has explained three important theories of motivation and indicated how science educators might develop learning environments which are more motivating for undergraduate students. Although a small group of motivational theorists (Perry, Turner & Meyer, 2006) have been concerned with developing motivational interventions in naturally occurring classroom environments, most published intervention research in the educational psychology literature has involved experimental studies. Furthermore, the naturalistic interventions so far conducted have been in primary or high schools (Perry, Turner & Meyer, 2006), and not in tertiary contexts. Since 2008, however, a small interdisciplinary team of researchers at the University of Sydney (Bartimote-Aufflick, Walker, Smith, Taylor, George, Sharma, & Collier, 2008; Bartimote-Aufflick, Walker, Smith, Sharma, Collier, & George, 2009) have been engaged in a project designed to make units of study in the faculties of Science, Veterinary Science, Pharmacy and Education and Social Work more motivating and interesting for students. Over the two and a half years of the project to date, the project team has provided workshops on motivation for staff teaching in eighteen units of study located in these faculties.



The workshops have provided staff with an understanding of motivational theories and concepts and opportunities to discuss ways of making their units more motivating.

A motivation survey has been developed by the research team (Bartimote-Aufflick et al, 2008; Bartimote-Aufflick et al, 2009) to assess self-efficacy beliefs, content interest, intrinsic goals, teacher and peer interaction, grades or extrinsic motivation, and career or professional orientation to learning. This survey instrument has been shown to have appropriate psychometric properties. The design of the project has elements in common with design-based research (Reimann, In Press; Walker, In Press) as motivational and other data have been collected prior to the motivation workshop and then over several years after the workshop. Thus, although both pretest and posttest data have not been obtained from the one cohort of students, and strong causal inferences cannot be made, comparisons of pre-intervention and post-intervention findings will provide some evidence concerning the impact of the workshops.

Currently, only general results for this research (Bartimote-Aufflick et al, 2008; Bartimote-Aufflick et al, 2009) are able to be reported; results obtained with students from thirteen units of study, and involving one thousand two hundred and forty five students, demonstrate moderate levels of content interest and intrinsic motivation, with 44.6% and 45.8% of students respectively indicating that they were interested and intrinsically motivated, and 27.5% and 25.3% of students indicating that they were not interested or intrinsically motivated. In relation to both content interest and intrinsic goals, a sizeable percentage of students made neutral responses. Approximately 37% of students indicated that they had a sense of efficacy in their units of study while approximately 24% lacked a sense of efficacy, and a relatively large percentage of students made a neutral response on this scale. Approximately 61% percent of students were motivated by grades while 16% were not, and a relatively large percentage of students made neutral responses on this scale. Approximately 39% of students were motivated by teacher and peer interactions while 25% were not. Finally, approximately 76% of students were motivated by a career or professional orientation, while approximately 10% were not, and a relatively low percentage of students made neutral responses on this scale.

What is most evident and most concerning about these findings is the relatively low percentage of students who considered themselves to be efficacious in their units of study. Consequently, many of the staff members involved in the project have made the enhancement of efficacy beliefs a priority in changing and re-developing their units of study.

## **A sociocultural approach to motivation**

I turn now to a brief overview of the sociocultural approach to motivation, an emerging approach to the understanding of motivation in educational contexts (Sivan, 1986; Walker, 2010; Walker, et al., 2010; Walker, Pressick-Kilborn, Arnold & Sainsbury, 2004). While person-in-context approaches to motivation accord theoretical primacy to individual processes in explaining motivation, the sociocultural approach accords theoretical primacy to social explanations of motivation, although it recognises that social and individual processes are interdependent. The sociocultural approach sees motivation as fundamentally social in nature and considers that motivational standards, values, beliefs and expectations are initially social in nature but are internalised to become individual attributes. In the sociocultural approach, motivation is considered to be internalised through social interaction and is subsequently manifested in collaborative and individual activity.

According to this emerging approach (Walker, 2010; Walker et al, 2010) motivation is considered to be influenced by the cultural practices in which students are engaged, by the creation of zones of proximal development, and by the nature of the interpersonal relations and extent of intersubjectivity between students, and between teachers and students. Interpersonal relations and intersubjectivity influence the creation of zones of proximal development which in turn influence the internalisation of motivation.

Culture and cultural practices are considered, from a sociocultural perspective, to play a critical role in the construction and emergence of motivation. Cultural practices (Miller & Goodnow, 1995) are recurrent actions or activities that may be maintained, changed or challenged. They are valued by the communities that engage in them and are associated with a sense of belonging or identity and with particular forms of discourse. They help to structure learning and thinking activities and have motivational and affective properties and consequences. The academic practices of the science laboratory, for instance, are one type of valued cultural practice. Sociocultural theorists (Walker, 2010; Walker et al, 2010; Walker et al., 2004) consider that motivation is socially constructed as learners engage in academic practices, and so can be considered to emerge from these practices.

The zone of proximal development (ZPD) refers to the learner's ability to successfully complete tasks with the assistance of more capable other people, and for this reason it is often discussed in relation to assisted or scaffolded learning. The creation of zones of proximal development involves assistance with the cognitive structuring of learning tasks and sensitivity to the learners current capabilities. Sociocultural (Sivan, 1986) and mainstream motivational theorists (Brophy, 1999) have observed that these aspects of the zone of proximal development make it an inherently motivational zone; the ZPD is optimally challenging (Sivan, 1986) because tasks are calibrated to the learner's level, while appropriate support and scaffolding ensure that tasks can be completed successfully. Assistance from others also helps the learner to learn how to work on difficult tasks and to control or manage anxiety and frustration in the process. Additionally, working within the zone of proximal development is inherently motivating because it involves the transfer of responsibility, or control, for learning, from the teacher or more capable other to the learner. This transfer of control is motivating for the student as it acknowledges student mastery of the task, and hence the learner's developing efficacy. Interaction within the zone of proximal development is also likely to lead to the recruitment of the learner's interest in the task or knowledge domain as the learner comes to value and appreciate the knowledge which is valued by a respected, more capable other person. Furthermore, as learners come to achieve mastery in a knowledge domain, they are more likely to appreciate the relevance and value of the knowledge domain.

The zone of proximal development can also be considered to be a relational (Goldstein, 1999) or affective zone. Goldstein (1999) has characterised the ZPD as a socially mediated space that is formed through relationships involving sensitivity and trust. In a classroom, this space is created by the interactions between students and between students and their teacher, as they engage in supportive activities that develop learner confidence and positive emotions. This consideration of the ZPD as a shared affective zone also has important motivational implications; the emotional quality and tone of interaction in the ZPD and the sense of caring engendered can have important implications for learner engagement in learning and for the learner's willingness to challenge him or herself.

The reciprocal notions (Walker et al, 2010) of transformative internalisation and externalisation also play a central role in the sociocultural approach to motivation. They explain the processes through which aspects of the social world become a part of the world of the learner, and conversely how the learner's actions and behaviour impact upon their social world. Viewed from the perspective of motivation in the classroom, the process of internalisation refers to the way individuals selectively internalise values and standards from their interactions with others in the zone of proximal development as they engage in classroom academic practices. The process of internalisation is active, constructive and transformative (Walker et al., 2004) so that the goals, values and standards constructed by the learner cannot be considered to be transmitted by others. Rather, goals, standards and values are actively modified or changed by the learner in the process of internalisation. When standards and values have been internalised by a learner they are subsequently externalised in the form of motivated action, behaviour and language, so that internalisation may be inferred from these expressions of classroom engagement. It is important to recognise, however, that externalisation is also an active and transformative process, so that standards and values are transformed as learners externalise them in interaction with peers and others.

Although much of the literature on the emerging sociocultural approach to motivation has, to date, been theoretical in nature (Sivan, 1986; Hickey, 1997; Pressick-Kilborn, Sainsbury & Walker, 2005; Walker, 2010; Walker et al, 2010; Walker et al, 2004), important empirical research which bears directly and indirectly on the issues discussed here has recently been reviewed by Walker et al (2010). Additionally, doctoral research by Arnold (2005; Arnold & Walker, 2008), Pressick-Kilborn (2010; Pressick-Kilborn & Walker, 2002) and Sainsbury (2009; Sainsbury & Walker, 2007) has provided empirical support for some of these theoretical issues.

From the perspective of interventions to enhance motivation, the sociocultural perspective on motivation emphasises the nature and quality of interpersonal relationships between students and their teachers and peers, as these relationships influence the internalisation and externalisation of motivational standards and values. Interpersonal relations and intersubjectivity are also important for understanding the way that learners and their peers regulate each other's activities, and their motivated engagement in those activities. In addition to an emphasis on interpersonal relations, the sociocultural approach also emphasises the way that the teacher scaffolds the learning environment to ensure effective learning and motivation. It is important for both effective learning and motivation that teachers create learning environments which assist students to cognitively structure their learning and which are sensitive to student capabilities.

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